AR #83 PSIB ANOMALY
AND LOW POWER RECOVERY TIMELINE II

At 09:00:50z on Friday, September 22nd (00/266), the instruments were autonomously powered off a second time due to the detection of low battery state of charge (<70%) in PSIB-A telemetry. This telemetry became corrupt as part of a further failure within the PSIB-A, which coincided with increased temperatures in the PSIB-A analog and power cards. Several hours later, most of the remaining PSIB-A telemetry railed low, including essential bus voltage and current readings. The analog and power card temperatures then returned to normal levels, which seems to indicate that the cascading effect of failed multiplexers within the PSIB-A has concluded. Unfortunately, the result is that the PSIB-A can no longer be used for reliable power system monitoring. The symptoms experienced on PSIB-B are not the same as those on PSIB-A. This points to the probability that the failure experienced on PSIB-B may not be directly related to that experienced by PSIB-A, and the PSIB-B problems are not as severe as the failures experienced on the A side. The PSIB-B cell voltage telemetry is no longer valid except battery 2 cells 15-22, but all the remaining PSIB-B telemetry is normal and stable. The cell voltage telemetry does exhibit unusual behavior, however, because the battery 1 cells all rail high for approximately the last 16 minutes of each eclipse period. Once the PSIB-B problems were believed to be different from the A side and less severe, the decision was made to power on the science instruments again starting with the 00/266 17:01z event.

Following additional risk analysis, the decision was made to change the power management configuration from Constant Current Mode with a cap of 12 amps per battery to Peak Power Tracking with a VT-Level of 4. If further specific failures occur on both PSIB-A and PSIB-B, the capability to command the SPRU could be jeopardized, although the PSIB command pathways have not been affected by this anomaly. The reasoning behind this decision was that any risk this new charging profile might have on the batteries or individual cells would still be preferable to having the SPRU in the Constant Current charge mode with no capability to command it out of that mode, which would effectively end the mission. Depending on the outcome of further analysis, however, a return to CC mode could be made to reduce the battery charge current levels if it is concluded that there is no real risk of losing the dual command capability to the SPRU. If this decision cannot be made, then other operational scenarios are being considered to reduce the battery charge current levels, including possible changes to the solar array tracking configuration. The command activities for the second loadshed recovery and new power management configuration are listed below.

Friday, September 22nd (00/266)

1. Analog Card Temperature begins increasing from 22° to > 26° C	00/266 06:48:00z
2. TSM-1 detects Battery 1 State of Charge < 70%	00/266 08:59:12z
3. RTS 2 (Loadshed) Starts, which leads to the execution of RTSs 13, 15, and 34	00/266 08:59:14z
4. CERES/LIS/TMI/HPT/VIRS/PR OFF (TMI Survival Heaters ON)	00/266 09:00:50z
5. Analog Card Temperature peaks at 28° C and remaining PSIB-A low voltage analog telemetry drops out	00/266 16:26:00z

INVESTIGATION / RECOVERY ACTIVITIES

Friday, September 22nd (00/266)

1. TSMs 1-8 Disabled and Low Power Checking Disabled to prevent further loadsheds once instruments are back on 00/266 17:08:19z
2. PR relay configuration set using WPR_RFPS_RELAY procedure 00/266 17:11:41z
3. High Pressure Transducer turned back ON using /RA_HPT_ON 00/266 17:13:52z
4. MPWRON procedure started for the TMI Instrument 00/266 17:16:28z
5. MSPINUP procedure started for the TMI Instrument 00/266 17:17:33z
6. MRCVRSON procedure started to power ON the TMI receivers 00/266 17:20:10z
7. LPWRON procedure started to power ON the LIS Instrument 00/266 17:20:44z
8. LISCONFIG procedure started to reconfigure the LIS Instrument 00/266 17:22:14z
9. VPWRON procedure started to power ON the VIRS Instrument 00/266 17:24:06z
   *PSIB-A Analog Card temperatures returned to normal levels 00/266 17:40:00z
10. PRSTARTON procedure started to power ON the PR instrument 00/266 18:01:40z
11. PTXCODE103 procedure started by PRSTARTON at 00/266 18:06:33z
12. PRXCODE103 procedure started by PRSTARTON at 00/266 18:11:54z
13. /PRXATTN SEL9DB command sent for final nominal configuration 00/266 18:18:01z
14. VNORMOUTGAS procedure started to begin VIRS Outgassing ops 00/266 18:19:53z
15. Transition to VT-4 and Peak Power Tracking as a precaution 00/266 19:38:22z
16. VOUTGAS_HTRS procedure started to continue Outgassing ops once mounting ring temperature > 25°C 00/266 20:34:31z

Sunday, September 24th (00/268)

1. VIRS instrument Resets itself (known anomaly) 00/268 03:26:10z
2. VIRS Outgassing is restarted (VNORMOUTGAS procedure) 00/268 08:12:07z
3. VOUTGAS_HTRS procedure started to continue Outgassing ops once mounting ring temperature > 25°C 00/268 09:23:11z
4. VOUTGAS_HTRS procedure started to continue Outgassing ops once intermediate stage temperature > 289°K 00/268 12:38:33z
5. PRSURVHTRS procedure started to re-enable PR K1 Surv Htr Relay 00/268 16:18:20z
   (This procedure is typically run approximately 48 hours after PR ON)

Monday, September 25th (00/269)

1. VINITOUTGAS_END procedure started to conclude Outgassing ops 00/269 14:29:44z
2. VRADCDROP procedure started to open Radiative Cooler Door 00/269 14:30:39z
3. RTSs 2, 15 Re-enabled and Loadshed Capability restored to power off instruments if spacecraft should transition to SunAcq or Safehold 00/269 15:14:06z
4. VOUTGAS_HTRS procedure started once Intermediate Stage

temperature cools to below 220°K 00/269 17:39:06z

5. VMISSMD procedure started to resume VIRS Science Operations 00/269 17:39:44z
6. Low Power Loadshed Capability restored for PSIB-B low bus voltage detection only 00/269 21:34:49z

Remaining activities to be performed while anomaly investigation continues:

1. Load the PSIB software patch to PSIB-B
2. Develop an alternate method to detect a low bus voltage level if PSIB-B telemetry corrupts further
3. Modifications to TSMs / RTSs and low bus voltage level related to the Power subsystem
4. Power ON the CERES instrument when solar beta angle is at or near zero degrees
5. Return to Constant Current Mode for battery charging once risk analysis deems it safe to do so
6. Develop alternate strategies to reduce stress on batteries if Peak Power Tracking continues: possibly off-pointing the solar arrays and/or only transition to CC Mode during certain parts of each orbit